I CLAIM

1. A fluorovinyl ether of formula:

$$CFX=CXOCF_2OR$$
(I)

wherein:

1) R is a C_2-C_6 linear or branched perfluoroalkyl group, a C_5-C_6 cyclic perfluoroalkyl group, or a linear or branched perfluorooxyalkyl group comprising 2 to 6 carbon atoms and 1 to 3 oxygen atoms;

2) up to two fluorine atoms of the perfluoroalkyl group or the perfluorooxyalkyl group can be replaced with atoms selected from the group consisting of H, Cl, Br, and I; and

3) X is F or H.

2. The fluorovinyl ether of claim 1 wherein R is CF_2CF_2Y and Y is F or OCF_3.

3. The fluorovinyl ether of claim 2 wherein each X is F.

4. The fluorovinyl ether of claim 3 wherein Y is F.

5. A polymer obtained by the polymerization, alone or in combination with one or more copolymerizable comonomers, of

1) a fluorovinyl ether of formula:

$$CFX=CXOCF_2OR$$
(I)

wherein:

a) R is a C_2-C_6 linear or branched perfluoroalkyl group, a C_5-C_6 cyclic perfluoroalkyl group, or a linear or branched perfluorooxyalkyl group comprising 2 to 6 carbon atoms and 1 to 3 oxygen atoms;

b) up to two fluorine atoms of the perfluoroalkyl group or the perfluorooxyalkyl group can be replaced with atoms selected from the group consisting of H, Cl, Br, and I; and

c) X is F or H.

6. The polymer of claim 5 wherein R is CF_2CF_2Y and Y is F or OCF_3.

7. The polymer of claim 6 wherein each X is F.

8. The polymer ether of claim 7 wherein Y is F.

9. The polymer of claim 5 wherein the fluorovinyl ether is copolymerized with at least one comonomer that is a fluorinated compound having at least one polymerizable carbon-carbon double bond.

10. The polymer of claim 9 wherein the fluorinated compound further comprises at least one atom selected from the group consisting of hydrogen, chlorine, bromine, iodine, and oxygen.

11. The polymer of claim 5 wherein the the fluorovinyl ether is copolymerized with one or more comonomers that are a C_2-C_8 olefinically unsaturated hydrocarbon.

12. The polymer of claim 5 wherein the fluorovinyl ether is polymerized with one or more copolymerizable comonomers selected from the following:

1) C_2-C_8 perfluoroolefins;

2) C_2-C_8 fluoroolefins;

3) C_2-C_8 chlorofluoroolefins, C_2-C_8 bromoclhoroolefins, and C_2-C_8 iodofluoroolefins;

4) fluoroalkyl vinyl ethers, having the structure $CF_2=CFOR^2_f$, wherein R^2_f is a C_1-C_6 perfluoroalkyl group in which 0 or 1 of the fluorine atoms are replaced with an atom selected from bromine and chlorine;

5) perfluorooxyalkylvinyl ethers of structure $CF_2=CFOX^a$ wherein X^a is selected from a C_1-C_{12} alkyl group, a C_1-C_{12}

oxyalkyl group, and a C_1-C_{12} fluorooxyalkyl group having at least one ether oxygen,;

6) sulphonic monomers having the structure CF_2=CFO$X^b SO_2F$, wherein X^b can be CF_2CF_2, $CF_2CF_2CF_2$, or $CF_2CF(CF_2X^c)$, and wherein X^c is selected from F, Cl, Br.

13. The polymer of claim 12 wherein the perfluoroolefin is selected from tetrafluoroethylene (TFE), hexafluoropropene (HFP), and hexafluoroisobutene.

14. The polymer of claim 12 wherein the fluoroolefin is selected from the group consisting of vinyl fluoride (VF), vinylidene fluoride (VDF), trifluoroethylene, chlorotrifluoroethylene (CTFE), bromotrifluoroethylene, and a fluoroolefin of structure CH_2=CH-R^2_f, wherein R^2_f is a C_1-C_6 perfluoroalkyl group.

15. The polymer of claim 12 wherein R^2_f is selected from a trifluoromethyl group, a bromotrifluoromethyl group, or a heptafluoropropyl group.

16. The polymer of claim 12 wherein the perfluorooxyalkyl group is the perfluoro-2-propoxypropyl group.

17. The polymer of claim 5 wherein the amount of fluorovinyl ether polymerized is between about 0.1 mole % and about 20 mole %, the remainder comprising one or more copolymerizable comonomers.

18. The polymer of claim 17 wherein the amount of fluorvinyl ether polymerized is between about 15 mole % and about 20 mole %, the remainder comprising one or more comonomers.

19. The polymer of claim 5 wherein the polymer is elastomeric.

20. The polymer of claim 5 wherein the polymer is plastomeric.

21. A process for making a fluorovinyl ether of formula

$$CFX=CXOCF_2OR$$
(I)

wherein:

1) R is a C_2-C_6 linear or branched perfluoroalkyl group, a C_5-C_6 cyclic perfluoroalkyl group, or a linear or branched perfluorooxyalkyl group comprising 2 to 6 carbon atoms and 1 to 3 oxygen atoms;

2) up to two fluorine atoms of the perfluoroalkyl group or the perfluorooxyalkyl group can be independently replaced with an atom selected from the group consisting of H, Cl, Br, and I; and

3) X is F or H;

comprising the steps of

a) contacting hypofluorite, $CF_2(OF)_2$, with a first olefin of structure $R_1R_2C=CR_3R_4$, wherein R_1 and R_4 are the same or different and selected from H and F, and R_2 and R_3 are the same or different and selected from H and Cl, to form a first intermediate hypofluorite of structure

$$F\text{-}CR_1R_2\text{-}CR_3R_4\text{-}O\text{-}CF_2OF$$
(VI)

and

b) contacting the first intermediate hypofluorite (VI) with a second olefin having structure $R_5R_6C^1=C^2R_7R_8$ to form a second itermediate hypofluorite

$$F\text{-}CR_1R_2\text{-}CR_3R_4\text{-}OCF_2O\text{-}C^2R_5R_6\text{-}C^1R_7R_8\text{-}F$$
(VII)

wherein R_5, R_6, R_7, and R_8 are F; or one of R_5, R_6, R_7, and R_8 is a C_1-C_4 linear or branched perfluoroalkyl group and the others of R_5, R_6, R_7, and R_8 are F; or

one of R_5, R_6, R_7, and R_8 is a C_1-C_4 linear or branched perfluorooxyalkyl group containing from one to three oxygen atoms and the others of R_5, R_6, R_7, and R_8 are F; or either pairing R_5 and R_7 or R_6 and R_8, together with the carbon atoms to which they are attached, are linked to form a perfluorinated C_5-C_6 cycloalkyl group and the others of R_5, R_6, R_7, and R_8 not so linked are F;

and

c) when R_2 and R_3 are both Cl, subjecting the second intermediate (VII) to a dehalogenation reaction, or, when one of R_2 and R_3 is H, subjecting the second intermediate (VII) to a dehydrohalogenation reaction;

with the proviso that when one of R_5, R_6, R_7 or R_8 is a C_2-C_4 linear or branched fluoroalky group or a C_2-C_4 linear or branched fluoroalkoxy group comprising from one to three oxygen atoms; then one or two of the remaining three of R_5, R_6, R_7, and R_8 are F and the remaining one or two of R_5, R_6, R_7, R_8 are selected from H, Cl, Br, and I, with the proviso that, where only one of said remaining three of R_5, R_6, R_7, and R_8 is F, then the remaining two of R_5, R_6, R_7, and R_8 are the same and linked to the same carbon atom; and further with the proviso that when R_5 and R_7 together with the carbon to which they are attached, or R_6 and R_8 together with the carbon atom to which they are attached, are linked to form a cyclic then one of the remaining two of R_5, R_6, R_7, and R_8 is F and the other is selected from H, Cl, Br, and I.

22. The process of claim 21 wherein the second olefin is reacted with hypofluorite in place of first olefin and the first intermediate hypofluorite is then reacted with the first olefin.

23. The process of claim 21 wherein the contacting is in a continuous process in which the mole amount of hypofluorite contacted is equal to or greater than the mole amount of first olefin $R_1R_2C=R_3R_4$ contacted and further wherein the residence time in the reactor is between about 0.05 and about 120 seconds, the temperature is between about -40° and about -150°C, and the first intermediate hypofluorite of the reaction of the first olefin with hypofluotite is continuously reacted with the second olefin.

24. A process according to claim 21 wherein the concentration of second olefin $R_5R_6C=CR_7R_8$ is constant and greater than about 0.01M and the temperature is between about -20°C to -100° C.

25. The process of claim 24 wherein the concentration of second olefin is equal to or greater than about 3M.

26. In a process for making a fluorovinyl ether of structure:

$$CFX=CXOCF_2OR$$
(I)

wherein:

1) R is a C_2-C_6 linear or branched perfluoroalkyl group, a C_5-C_6 cyclic perfluoroalkyl group, or a linear or branched perfluorooxyalkyl group comprising 2 to 6 carbon atoms and 1 to 3 oxygen atoms;

2) up to two fluorine atoms of the perfluoroalkyl group or the perfluorooxyalkyl group can be independently replaced with an atom selected from the group consisting of H, Cl, Br, and I; and

3) X is F or H;

the step of:

contacting a first fluoroalkene with a hypofluorite to form a first intermediate; then contacting the first intermediate with a second fluoroalkene to form a second intermediate;

1) the hypofluorite is of structure $X_1X_2C(OF)_2$ wherein X_1 and X_2 are the same or different and selected from F and CF_3; and

2) the first and second fluoroalkenes may be the same or different and are selected from $R^A_1R^A_2C=CR^A_3R^A_4$ and $R^A_4R^A_5C=CR^A_7R^A_8$ wherein each ofR^A_1, R^A_2, R^A_3, R^A_4, R^A_5, R^A_6, R^A_7, and R^A_8 are the same or different and are selected from the group consisting of H, F, Cl, Br, I, $-CF_2OSO_2F$, $-SO_2F$, $-C(O)F$, C_1-C_5 linear or branched perfluoroalkyl, and linear or branched oxyperfluoroalkyl.